



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/616,998	07/11/2003	Hae-Kyoung Kim	030681-531	2771
21839	7590	06/20/2006	EXAMINER	
BUCHANAN INGERSOLL PC (INCLUDING BURNS, DOANE, SWECKER & MATHIS) POST OFFICE BOX 1404 ALEXANDRIA, VA 22313-1404			ONEILL, KARIE AMBER	
			ART UNIT	PAPER NUMBER
			1745	

DATE MAILED: 06/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/616,998

Applicant(s)

KIM, HAE-KYOUNG

Examiner

Karie O'Neill

Art Unit

1745

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 14 April 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_

- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Remarks***

Claims 1-29 are pending in this action. Claims 22-29 have been added as new.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 22 and 24 recite the limitation "the cationic surfactant" in line 2. There is insufficient antecedent basis for this limitation in the claim. Claims 23 and 25 are dependent upon Claims 22 and 24, respectively, and are also objected to.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-3, 6-7, 9-10, 14-15, 18 and 21 are rejected under 35 U.S.C. 102(e) as being anticipated by Taft , III et al. (US 6,630,265 B1).

With respect to Claim 1, Taft discloses a nanocomposite electrolyte membrane for a fuel cell, comprising: a polymer based binder, an inorganic cation exchange material including clays and silicates, and a silica based binder (column 5 lines 15-17) in which the silicate nanoparticles are intercalated with the polymer through mechanical agitation (see example 1).

With respect to Claim 2, Taft discloses the clay silicate being selected from a group consisting of smectite and vermiculite and a mixture of materials (column 5 lines 30-35).

With respect to Claim 3, Taft discloses the silicate comprising smectite and the smectite being selected from the group consisting of montmorillonite, saponite, beidellite, hectorite, and a mixture of the foregoing materials (column 5 lines 30-35).

With respect to Claim 6, Taft discloses the cation exchange groups of the polymer being selected from the group consisting of sulfate, phosphate or carbonate groups (column 6 lines 17-19).

With respect to Claim 7, Taft discloses the polymer with cation exchange groups as being a homopolymer or copolymer of epoxides, thermoplastics and styrene polymer blends or mixtures thereof (column 6 lines 12-17).

With respect to Claim 9, Taft discloses the electrolyte membrane as having a thickness ranging from about 10 $\mu$ m to 200 $\mu$ m and preferably from about 45 $\mu$ m to 100 $\mu$ m (column 6 lines 42-45).

With respect to Claim 10, Taft discloses a fuel cell comprising a cathode where a reduction of an oxidizing agent occurs, an anode where oxidation of fuel occurs and the nanocomposite electrolyte membrane according to claim 1 interposed between the anode and cathode (column 6 lines 62-67 and column 7 lines 1-9).

With respect to Claim 14, Taft discloses the fuel cell of Claim 10 wherein the clay silicate being selected from a group consisting of smectite and vermiculite and a mixture of materials (column 5 lines 30-35).

With respect to Claim 15, Taft discloses the fuel cell of claim 14 wherein the silicate comprising smectite and the smectite being selected from the group consisting of montmorillonite, saponite, beidellite, hectorite, and a mixture of the foregoing materials (column 5 lines 30-35).

With respect to Claim 18, Taft discloses the fuel cell of Claim 10 wherein the cation exchange groups of the polymer being selected from the group consisting of sulfate, phosphate or carbonate groups (column 6 lines 17-19).

With respect to Claim 21, Taft discloses the fuel cell of Claim 10 wherein the electrolyte membrane as having a thickness ranging from about 10 $\mu$ m to 200 $\mu$ m and preferably from about 45 $\mu$ m to 100 $\mu$ m (column 6 lines 42-45).

Claims 26 and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by Blanton et al. (US 6,555,610 B1).

With respect to Claim 26, Blanton et al. discloses a membrane consisting essentially of: a polymer having cation exchange groups (polyethylene oxide); silicate

Art Unit: 1745

nanoparticles (smectite or montmorillonite clay) dispersed in the polymer (column 4 lines 44-50) and a cationic surfactant adsorbed within the silicate nanoparticles (column 7 lines 2-5). According to MPEP 2111.03, absent a clear indication of what the basic and novel characteristics actually are, "consisting essentially of" will be construed as equivalent to "comprising" (PPG, 156 F.3d at 1355, 48 USPQ2d).

With respect to Claim 29, Blanton et al. discloses a method of forming nanocomposite membrane comprising, mixing silicate nanoparticles with surfactant water and a polymer having cation exchange groups (column 7 lines 2-5); and drying the mixture to form a nanocomposite membrane (column 7 lines 46-48).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 4-5 and 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taft, III et al. (US 6,630,265 B1) in view of Blanton et al. (US 6,555,610 B1).

Taft discloses a nanocomposite electrolyte membrane for a fuel cell and the fuel cell of Claims 1 and 10 above, respectively, but does not disclose the silicate nanoparticles having an average diameter of 1-100nm and the amount of silicate nanoparticles in a range of 1-30% based on the total weight of the nanocomposite electrolyte membrane.

With respect to Claims 4 and 16, Blanton et al. discloses a nanocomposite material in which one of the components is of the order less than 400 nanometers and the silica clay material belongs to the group of smectites and montmorillonites (column 4 lines 61-66) comprising particles of a lateral dimension between 0.01 $\mu$ m and 10 $\mu$ m which is in the range of 1-100nm (column 5 lines 15-19).

With respect to Claims 5 and 17, Blanton discloses wherein the amount of silicate nanoparticles is in a range of less than 99% and preferably less than 50% and more preferably less than 10% based on the total weight of the electrolyte membrane (column 6 lines 41-54).

Taft and Blanton are analogous art because they are from the same field of endeavor, membranes. At the time of the invention it would have been obvious to one of ordinary skill in the art to include the features of the Blanton reference with the membrane of the Taft reference for the purpose of improving mechanical properties of membranes (column 4 line 18).

Claims 8, 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taft, III et al. (US 6,630,265 B1) in view of Grot et al. (US 5,919,583).

Taft et al. discloses the nanocomposite electrolyte membrane of Claims 1 and 10 above, but does not disclose the polymer cation group as being a highly fluorinated polymer with sulfonate groups as proton exchange groups at terminals of side chains and containing fluorine atoms that amount to at least 90% of the total number of fluorine

Art Unit: 1745

and hydrogen atoms bound to carbon atoms of the backbone side chains of the polymer.

Grot et al. discloses cation exchange groups consisting of sulfonate, carboxylate, phosphate, imide, sulfonamide and sulfonamide groups, further including copolymers of trifluoroethylene, tetrafluoroethylene, styrene-divinyl benzene, and,  $\alpha,\beta,\beta$ -trifluorostyrene, with a polymer backbone which is highly fluorinated and the ion exchange groups are sulfonate groups and at least 90% of the total number of halogen and hydrogen atoms are fluorine atoms (column 3 lines 33-37 and 55-61).

Taft et al. and Grot et al. are analogous art because they are from the same field of endeavor, fuel cell electrolyte membranes. At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the cation exchange groups of the Grot et al. reference with the electrolyte membrane of Taft et al. for increasing the transport of protons across the membrane and for enhanced mechanical properties such as increased stiffness (Grot column 3 lines 2 and 30-31).

Claims 11-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taft, III et al. (US 6,630,265 B1) in view of Yen et al. (US 5,795,496).

Taft et al. discloses the fuel cell of Claim 10 above, but does not disclose wherein the cathode and anode are comprising catalyst layers containing carbon supported platinum catalysts, and the anode further comprises a platinum-ruthenium catalyst.



Yes et al. discloses an anode formed from platinum-ruthenium alloy particles dispersed in high surface area carbon (column 3 lines 32-34) and a cathode in which platinum particles are bonded to a carbon backing material (column 3 lines 57-58).

Taft et al. and yen et al. are analogous art because they are from the same field of endeavor, fuel cell electrolyte membranes. At the time of the invention it would have been obvious to one of ordinary skill in the art to combine the anode and cathode materials of the Yen et al. reference with the fuel cell of Taft et al. so that more efficient electro-oxidation is realized (Yes column 3 line 55).

#### ***Allowable Subject Matter***

Claims 27 and 28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The following is a statement of reasons for the indication of allowable subject matter: the closest prior art, Blanton et al., does not recite the nanocomposite membrane wherein the cationic surfactant comprises organic onium cations, more specifically cetylpyridium chloride, lauryl pyridium chloride or n-hexadecyl trimethylammonium bromide.

#### ***Response to Arguments***

Applicant's arguments, see Remarks pages 8-9, filed April 14, 2006, with respect to priority to Taft, III et al (US 2005/0244697) have been fully considered and are persuasive. The rejection of Claims 1-7, 9-10, 14-18 and 21 has been withdrawn.

Art Unit: 1745

However, upon further consideration, a new ground(s) of rejection is made in view of newly found prior art, Taft, III et al. (US 6,630,265 B1) and Blanton et al. (US 6,555,610 B1) which addresses the newly added claims and the claims not disclosed by the Taft reference.

Applicant argues that the Taft reference does not disclose or suggest silicate particles being intercalated with the polymer of layers of the silicate nanoparticles being exfoliated. However, Examiner interprets this claim to recite that the silicate nanoparticles being intercalated with the polymer merely means that they are dispersed within one another and holds to the rejection of this claim under the Taft (US 6,630,265) reference.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karie O'Neill whose telephone number is (571) 272-8614. The examiner can normally be reached on Monday through Friday from 8am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1745

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

  
PATRICK JOSEPH RYAN  
SUPERVISORY PATENT EXAMINER

Karie O'Neill  
Examiner  
Art Unit 1745

KAO